

L 5017--66

ACC NR: AP5026322

I. A. Strel'nikova for reprints of their papers." Orig. art. has: 2 figures.

ASSOCIATION: None

SUBMITTED: 17Nov64

ENCL: 02

SUB CODE: SS, OP

NO REF SOV: 004

OTHER: 002

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L 5017-66

ACC NR: AP5026322

ENCLOSURE: 01

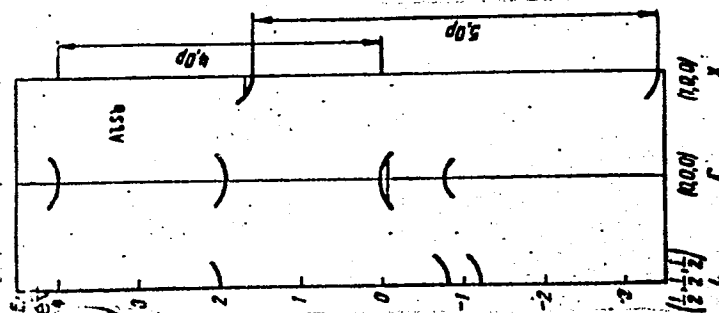


Figure 1. Energy diagram of AlSb zones at points  $\Gamma$ , L, and X.

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L 5017-66

ACC NR: AP5026322

ENCLOSURE: 02

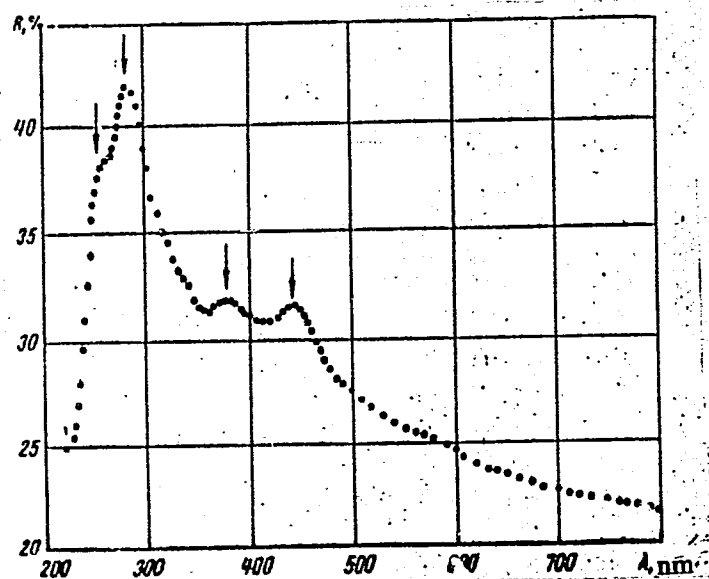


Figure 2. Reflection spectrum of aluminum antimonide.

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L 49035-65 EWT(1)/EWT(m)/EWT(m)/T/EWP(t)/EEC(b)-2/EWP(b) P1-4 IJP(c)  
 RHW/JD/OG

S/0181/65/007/003/0914/0915

ACCESSION NR: AP5006905

AUTHOR: Sobolev, V. V.

TITLE: Line spectra of edge absorption and emission of cadmium telluride crystals

SOURCE: Fizika tverdogo tela, v. 7, no. 3, 1965, 914-915

TOPIC TAGS: cadmium telluride, group II element, group VI element, line spectrum, absorption edge, emission edge

ABSTRACT: In view of the little attention paid to the edge absorption and emission of crystals of the  $A_{II}B_{VI}$  group, other than CdS and CdSe, the authors investigated the low-temperature absorption of thin layers and photoluminescence of single-crystal and polycrystalline CdTe in the region of the intrinsic absorption edge. At 77.3K, the absorption spectrum of CdTe films consisted of several broad lines at 7685, 7757, and 7817 Å, with a noticeable step on the continuous edge absorption curve at 7830 Å. A reduction of the temperature to 4.2K shifts the entire spectrum by ~ 37 Å (0.008 eV) to the short-wave region, and reduces the line width. At 4.2K the single crystal's emission spectrum consists of three narrow lines and

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ACCESSION NR: AP5006905

four narrow bands (7960, 8055, 8120 and 8385, 8520, 8650, and 8800 Å, respectively). In the case of large-crystal layers the spectrum consists of four lines (7660, 7750, 7855, and 7915 Å) and three bands (8000 and 8085 [doublet], 8190, and 8330 Å). An analysis of the results shows that the spectra are much closer to those of CdS and CdSe than assumed by other workers, and exhibit similar relation to free exciton, exciton, or exciton-impurity character of the lines. Orig. art. has: 1 figure.

ASSOCIATION: Institut fiziki i matematiki AN MSSR, Kishinev (Institute of Physics and Mathematics, AN MSSR)

SUBMITTED: 02Apr64

ENCL: 00

SUB CODE: SS, OP

HR REF SOV: 005

OTHER: 010

Card 2/2

11-0017, V-V.

Reflection Spectrum of polyolefinite. Opt. I spektr. 18 no.2:334-  
335 F 155. (MIRA 18 4

L 61674-65 EWT(1)/EWT(m)/T/EWP(t)/EWP(b)/EWA(c) Pi-4 IJP(c) JD  
 ACCESSION NR: AP5011119 UR/0051/65/018/004/0648/0655  
 535.373.1

AUTHOR: Sobolev, V. V.

TITLE: Low-temperature luminescence of zinc selenide and zinc telluride

SOURCE: Optika i spektroskopiya, v. 18, no. 4, 1965, 648-655

TOPIC TAGS: zinc compound, luminescence, edge photoluminescence, exciton state, low temperature spectrum, band structure, line structure, crystal structure

ABSTRACT: The low-temperature spectra of the edge photoluminescence of ZnSe and ZnTe layers were investigated and were found to have complicated line and band structures. The layers were prepared by sublimation and the photoluminescence was excited by an SVDSH-1000 lamp through violet and ultraviolet filters. The spectra were photographed by reflection with a large-aperture spectrograph. The measurements were made at 77.3 and 4.2K. Three types of ZnSe radiation and two types of ZnTe radiation were observed. An analysis of the intensity and half-width distributions of the lines and the bands indicates that edge luminescence was observed. The nature of the crystal structure of the layers is deduced from a comparison of the obtained spectra and earlier data. It is concluded that exciton lines are more

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L 61674-65

ACCESSION NR: AP5011119

effectively produced in layers than in single crystals, 14  
and 5 tables. /

ASSOCIATION: None

SUBMITTED: 03Apr64

ENCL: 00

SUB CODE: OP, SS

NR REF SOV: 011

OTHER: 008

*llc*  
Card 2/2



L 64505-65 EPA(s)-2/EWA(c)/ENT(1)/ENT(m)/EWG(m)/EWP(b)/T/ENP(t) IJP(c) RDW/JD/  
 ACCESSION NR: AP5012607 JG UR/0051/65/018/005/0813/0819  
 535.512:535.33 + 535.34

AUTHOR: Sobolev, V. V.

TITLE: Reflection and absorption spectra of crystals of the  
 Group A<sup>II</sup> -- B<sup>VI</sup>

SOURCE: Optika i spektroskopiya, v. 18, no. 5, 1965, 813-819

TOPIC TAGS: cadmium compound, mercury compound, valence band, con-  
 duction band, absorption spectrum, light reflection, absorption edge,  
 spin orbit coupling

ABSTRACT: The absorption spectra of polycrystalline layers of hex-  
 agonal (wurtzite) CdS and cubic (sphalerite) CdTe, and the reflection  
 spectra of hexagonal (wurtzite) single-crystal CdS and CdSe and cubic  
 (sphalerite) polycrystals of HgS (cinnabarite) and HgSe and of  
 single-crystal HgTe and CdTe were investigated at 290 K and 1 -- 6 eV.  
 The polycrystalline layers were produced by sputtering of single

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L 64505-65

ACCESSION NR: AP5012607

crystals on quartz substrates at  $10^{-5}$  mm Hg and on glass substrates at  $10^{-2}$  mm Hg. The spectra were measured for reflection from natural surfaces, cleaved surfaces, or polished surfaces. The peaks of the various spectra are identified and their energies calculated and tabulated. The values of the spin-orbit splitting and the intrinsic absorption edge are calculated for different orientations. The structural absorption and reflection of the crystals are interpreted from the point of view of the observed spectra. The distance between the upper valence band and the lower conduction band is calculated at several points. Orig. art. has: 3 figures, 1 formula, and 3 tables.

ASSOCIATION: None

SUBMITTED: 02Apr64

NR REF SOV: 009

ENCL: 00

SUB CODE: OP

OTHER: 017

Card

L 4445-66 EWT(m)/ETC/ENG(m)/ENP(t)/ENP(b) IJP(c) RDW/JD  
 ACCESSION NR: AP5017896 UR/0051/65/019/001/0086/0096  
 535.37:548.0

AUTHOR: <sup>44,55</sup>  
Sobolev, V. V.

TITLE: <sup>21 44 55</sup>  
Edge luminescence of CdS, CdSe, and CdTe crystals

SOURCE: <sup>21 21 21</sup>  
 Optika i spektroskopiya, v. 19, no. 1, 1965, 86-96

TOPIC TAGS: cadmium selenide, cadmium sulfide, cadmium telluride,  
 luminescence spectrum, excitron, impurity center

ABSTRACT: In view of the contradictory character of the numerous investigations on edge luminescence, which were limited for the most part to CdS, the author attempted to detect and investigate edge luminescence spectra of other crystals isomorphous with CdS, namely CdSe and CdTe polycrystals. Pure coarsely-crystalline layers were prepared by vacuum sublimation on heated quartz substrates. Fluorescence was excited by an SVDSH-1000 lamp and photographed by reflection in spectrographs in the 700 Å region. There was no luminescence at room temperature, but bright edge photoluminescence appeared at 77.3K.

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L 4445-66

ACCESSION NR: AP5017896

9.

and even more at 4.2K. The changes in the line and band spectrum occurring upon cooling each of the crystals are described. Based on the character of the intensity distribution, the half-width of the lines and bands, and the wavelength distribution, the photoluminescence spectra can be distinctly divided into three groups: (1) emission lines that coincide in resonance with edge absorption lines; (2) the remaining emission lines on the longer-wavelength side; (3) the edge-band emission. The lines of the first group in the edge luminescence of the crystal can be attributed to resonance radiative decay of excitons with a shift of the annihilation lines towards longer wavelengths. The second group is due to various satellites of the exciton and bound exciton-impurity states. Arguments in favor of a close connection between excitons and the band edge luminescence are presented. The author thanks R. Yu. Khansevarov, L. P. Bogomazov, and N. Lazovskaya for much assistance in preparing the polycrystalline layers. Orig. art. has: 3 figures and 5 tables.

ASSOCIATION: None

SUBMITTED: 02Apr64

ENCL: 00

SUB CODE: OP, 55

NR REF SOV: 017

OTHER: 009

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*Lehr*

L 2373-66 LWT(1)/T IJP(c) GG  
 ACCESSION NR: AP5020827

UR/0020/65/163/004/0868/0869

AUTHORS: Kesamanly, F. P.; Kroitoru, S. G.; Rud', Yu. V.; Sobolev, V. V.; Syrbu, N. N.

TITLE: The energy band structure in crystals of the group A<sup>ii</sup>B<sup>iv</sup>C<sub>2</sub><sup>v</sup>

SOURCE: AN SSSR. Doklady, v. 163, no. 4, 1965, 868-869

TOPIC TAGS: semiconductor, zinc compound, conduction band, Brillouin zone

ABSTRACT: Investigations were made of the energy structure in minerals having the structure of chalcopyrite. The lowest conduction band is simple, and the highest valence band is triple. This paper examines the reflection spectra of ZnSnAs<sub>2</sub>, ZnSiP<sub>2</sub>, and ZnSiAs<sub>2</sub> in the region of 1-6 ev and at 293K. The spectral distribution of reflectivity showed two interse maximums for each crystal: at 265 and 600 mμ for the first, 280 and 330 mμ for the second, and 275-295 and 370 mμ for the third. The peak at 600 mμ for ZnSnAs<sub>2</sub> has a doublet structure with two maximums at 550 and 650 mμ. Spin orbit splitting for ZnSnAs<sub>2</sub> proved to be 5-10 times that for the other two. Because of the width of the peaks, doublet structure of a long-wave maximum was not observed in the reflectivity curves of the last two crystals. In Card 1/2

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ACCESSION NR: AP5020827

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general characteristics, the three minerals are very similar. It is concluded that the reflectivity spectra are due to allowed cross-over interzonal transitions at points in the Brillouin zone analogous to points L and X in crystals of group  $A^{iv}$  and  $A^{iii}_B$ . The great general and detailed similarity in reflectivity spectra of the tested crystals to the groups  $A^{iv}$  and  $A^{iii}_B$  strongly suggests a great similarity in structure of the energy bands and the nature of the chemical bonds of both groups. "The authors express their thanks to Professor D. N. Nasledov for his support of the present work." Orig. art. has: 2 figures and 1 table. *44, 55*

ASSOCIATION: Fiziko-tekhnicheskiy institut im. A. F. Ioffe, Akademii nauk SSSR (Physical and Technical Institute, Academy of Sciences SSSR); *44, 55* Institut prikladnoy fiziki, Akademii nauk MSSR (Institute of Applied Physics, Academy of Sciences MSSR)

SUBMITTED: 15Jan65

ENCL: 00

SUB CODE: SS

NO REF SOV: 005

OTHER: 003

BVK  
Card 2/2

SOBOLEV, V.V.

Contour of lines of exciton absorption of a cuprous oxide  
crystal. Dokl. AN SSSR 165 no.4:803-805 D '65.

(MIRA 18:12)

1. Institut prikladnoy fiziki AN Moldavskoy SSR. Submitted  
April 12, 1965.

L 13124-66 EWT(1)/EWT(m)/I/EWP(t)/EWP(b)/EWA(c) IJP(c) JD

ACC NR: AP5028909

SOURCE CODE: UR/0020/65/165/003/0534/0536

AUTHOR: Sobolev, V. V.

ORG: Institute of Applied Physics, Academy of Sciences MSSR  
(Institut prikladnoy fiziki Akademii nauk MSSR)

TITLE: Low temperature spectrophotometric investigations in the region  
of the long-wave edge of intrinsic absorption of cadmium selenide and  
sulfide single crystals

SOURCE: AN SSSR. Doklady, v. 165, no. 3, 1965, 534-536

TOPIC TAGS: absorption edge, cadmium selenide, cadmium sulfide,  
spectrophotometric analysis, absorption coefficient, oscillator  
strength, exciton

ABSTRACT: The author investigated the spectral distribution of the  
coefficient of absorption of pure and highly perfect thin ( $d = 0.2--$   
 $20 \mu$ ) single-crystal hexagonal plates of CdSe ( $\lambda 7000 -- 5300 \text{ \AA}$ ) and  
CdS ( $\lambda 7000 -- 4790 \text{ \AA}$ ) for the purpose of obtaining quantitative data  
on the contours of the exciton absorption bands. The investigations  
were carried out at 4.2K and 160K in polarized light, using diffraction

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UDC: 548.0:535 + 535.343



L 13124-66

ACC NR: AP5028909

( $D \approx 3.2 \text{ } \overset{\circ}{\text{A}}/\text{mm}$  in second order) and prism ( $D \approx 50 \text{ } \overset{\circ}{\text{A}}/\text{mm}$  in the region  $\lambda 5000 \text{ } \overset{\circ}{\text{A}}$ ) spectrometers in special cryostats described by the author earlier (Izv. AN MSSR No. 11, 1963). The receiver was a photomultiplier (FEU-17) cooled with liquid nitrogen. In the case of CdSe, the principal terms of three exciton lines could be separated at 6960, 6878, and 5600  $\overset{\circ}{\text{A}}$ . The absorption coefficients for these lines are measured and the half widths and oscillator strengths calculated and tabulated. The presence of three nonoverlapping exciton series in CdSe is confirmed. Indirect transitions are observed in a small region of frequencies near the edges of the direct transitions. From a comparison with theory it is concluded that most lines of the line edge absorption of CdSe actually should have an exciton origin. The line contour points to a strong exciton-phonon interaction at 160K and a weak interaction at 4.2K. Similar measurements were made for CdS by plotting the transmission curves of different pure crystals, and it is deduced that exciton-photon interaction plays an important role in CdS at 4.2K, in contradiction to the experimental and theoretical results by others. This report was presented by Academician V. P. Konstantinov. Orig. art. has 3 figures and 1 table.

SUB CODE: 20/ SUBM DATE: 08Mar65/ NR REF SOV: 013/ OTH REF: 005

Card

2/2 NW

L 14852-66 EWT(m)/EWP(t)/EWP(b) IJP(c) JD  
ACC NR: AP6001725 SOURCE CODE: UR/0020/65/165/004/0803/0805

AUTHORS: Sobolev, V. V.

ORG: Institute of Applied Physics, Academy of Sciences MSSR  
(Institut prikladnoy fiziki Akademii nauk MSSR)

TITLE: Contour of the exciton absorption line of a cuprous oxide crystal

SOURCE: AN SSSR. Doklady, v. 165, no. 4, 1965, 803-805

TOPIC TAGS: exciton absorption, cuprous oxide, absorption line, line width, oscillator strength, phonon interaction

ABSTRACT: The author points out that although  $\text{Cu}_2\text{O}$  has been thoroughly investigated in many respects, there are not enough data on such fundamental quantities as the absorption coefficient, half width, oscillator strength, and the line contour of its spectrum. The author therefore investigated, using recording spectral apparatus with dispersion  $3.2 \text{ \AA/mm}$ , at temperatures of 160 and 4.2K, the spectral dis-

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UDC: 548.0:535 + 535.343

L 14852-66

ACC NR: AP6001725

tribution of the absorption coefficient of single-crystal and polycrystalline  $\text{Cu}_2\text{O}$  with thickness 5 -- 300  $\mu$ . The exciton lines of the 'yellow' series with quantum numbers  $n = 1$  -- 6 and  $n = 1$  -- 7 were observed for 160K and 4.2K respectively. The green series of lines with  $n = 2$  and 3 at 160K and  $n = 2, 3, 4$  at 4.2K were also observed. An examination of the line contours shows that all the green lines and many of the yellow lines are strongly asymmetrical, and that the asymmetry increases with  $n$ . This indicates that the interaction between the excitons and the phonons changes from weak to strong with increasing  $n$ . When the temperature is lowered from 160 to 4.2K, the absorption intensity varies in a highly irregular fashion for the different lines of the green series. The absorption at the maximum increases strongly for  $n > 3$  and changes little for  $n = 2$  and 3. The results are compared with those by others and many differences are attributed to differences in the spectrometer dispersion and in the quality of the samples. This report was presented by Academician B. P. Konstantinov. Orig. art. has: 3 figures and 1 table.

SUB CODE: 20/ SUBM DATE: 08Mar65/ ORIG REF: 008/ OTH REF: 005

Card

2/2 *AC*

L 13868-66 EWT(1)/EWT(m)/EWP(t)/EWP(b) IJP(c) JD  
ACC NR: AP6002425 SOURCE CODE: UR/0020/65/165/005/1062/1064

AUTHOR: Sobolev, V. V.

ORG: Institute of Applied Physics, Academy of Sciences MSSR (Institut prikladnoy fiziki, Akademii nauk MSSR)

TITLE: Low temperature spectral distribution of the photoconductive effect in cadmium selenide and cadmium sulfide

SOURCE: AN SSSR. Doklady, v. 165, no. 5, 1965, 1062-1064

TOPIC TAGS: cadmium selenide, cadmium sulfide, photoconductivity, single crystal, spectral distribution, low temperature effect, exciton absorption, absorption edge

ABSTRACT: Spectral curves are studied for photocurrent in CdSe and CdS at 4.2°K using a monochromator with rather wide dispersion. Single crystal specimens were studied with dark currents of  $10^{-9}$ - $10^{-11}$  a and photocurrents of  $10^{-8}$ - $10^{-9}$  a at 77.3° and 4.2°K. The spectra for the photocurrents were taken in polarized light using an instrument with a linear dispersion of 5 Å/mm and a scanning time in the 200 Å spectral region of 5-30 minutes through a slot no more than 0.5 Å wide. The data

UDC: 535.215.4

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ACC NR: AP6002425

showed that "pure" crystals may be divided into two groups: crystals with peaks and crystals with dips on the photocurrent curves; the positions of the spectral peaks coincide with those of the dips and are highly stable. "Imperfect" crystals may also be divided into two groups. However, in this case there is a wide variation in the position and number of the peaks (or dips). The peaks (dips) in the spectral curves for the photocurrent of "pure" crystals coincide within 1-2 Å with the maxima of intense lines and bands in the line structure of the fundamental absorption edge. One of the most interesting and important results is a pronounced relationship between the structure of the photocurrent curves and the state of photoactivation of the crystals. The peaks (dips) in the photocurrent appear only when there is a certain minimum photoactivation for the specimens. There was no reliable observation of the structure of photocurrent curves in CdS at 4.2°K on a single one of the "irregular" absorption lines caused by stationary exciton-impurity complexes. The experimental data confirm the exciton origin of the peaks (dips) in the photocurrent curves for CdSe and CdS single crystals as well as the corresponding lines in the line structure of the edge absorption and emission. The exciton structure of the edge absorption shows up in the form of peaks (dips) in the spectral distribution of photocurrent because of the interaction between excitons and the photocenters which are formed when the crystal is exposed to radiation from the

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L 13868-66

ACC NR: AP6002425

fundamental absorption region. The results also indicate that there is no quasi-equilibrium distribution in these crystals between the energy levels of different excitons (A and B) and the levels of the same exciton. Orig. art. has: 2 figures.

SUB CODE: 20/      SUBM DATE: 05Sep65/      ORIG REF: 008/      OTH REF: 000

Card 3/3 mc

I. 28333-66 EWT(m)/ETC(f)/EWG(m)/T/EWP(t)/ETI LIP(c) RDW/JD  
ACC NR: AP6013093

SOURCE CODE: UR/0048/66/R30/004/0725/0726

AUTHOR: Sobolev, V. V.

ORG: Institute of Applied Physics, Academy of Sciences, MoldSSR (Institut priklad-  
noy fiziki Akademii nauk MoldSSR)

TITLE: Photoluminescence and absorption spectra of "pure" cadmium sulfide and  
cadmium selenide single crystals /Report, Fourteenth Conference on Luminescence held  
in Riga 16-23 September 1965/

SOURCE: AN SSSR. Izvestiya. Seriya fizicheskaya, v. 30, no. 4, 1966, 725-726

TOPIC TAGS: photoluminescence, luminescence spectrum, absorption spectrum, cadmium  
selenide, cadmium sulfide

ABSTRACT: Although there have been many studies devoted to the edge absorption and lu-  
minescence spectra of CdSe and CdS, many of the details of the complex structure of  
these spectra are still obscure. The present work was aimed at detailed investigation  
of the spectra by measurements on a large number (several hundred) perfect single  
crystals at 4.2 and 77.3°K by means of high dispersion (3 and 6 Å/mm) spectroscopic  
instruments with photographic recording. The luminescence spectra of one CdSe single  
crystal at 4.2 and 77.3°K and of two CdS crystals at 4.2°K are reproduced on a photo-  
graphic plate. The distinctive features of the absorption and emission spectra of the

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L 28333-66

ACC NR: AP6013093

0

"pure" CdSe and CdS single crystals are described at some length and the differences are noted between the spectra of the "cold" and "warm" crystal. The wavelengths of the lines distinguished in the various spectra are listed. Information is also given on the polarization of the lines. The observed complicated structure of the exciton absorption lines of CdSe and CdS can be explained on the basis of the theoretical data taking into account two molecules per unit cell and partially on the basis of the effects of spatial dispersion, the "extremum loop", and para- and ortho-excitons. Orig. art. has: 2 figures.

SUB CODE: 20/

SUBM DATE: 00/

ORIG REF: 008/

OTH REF: 006

Card 2/2 CC



L 31495-66 EWT(m)/ETC(f)/T/EWP(t)/ETI IJF(c) RDA/JD  
ACC NR: AP6013024 SOURCE CODE: UR/0051/66/020/004/0673/0677

AUTHOR: Sobolev, V. V.

ORG: none

TITLE: Nature of the fine structure of the absorption edge lines of single crystals of cadmium selenide and sulfide

SOURCE: Optika i spektroskopiya, v. 20, no. 4, 1966, 673-677

TOPIC TAGS: cadmium sulfide, cadmium selenide, single crystal, absorption edge, absorption line, exciton absorption, Doppler shift, oscillation strength

ABSTRACT: The author presents a summary of his own earlier data (Opt. i spektr. v. 16, 76, 1964 and elsewhere) as well as data by others on the absorption line spectrum of single-crystal CdSe and CdS at 4.2K, obtained with very thin samples and using a spectrograph of large dispersion 3 and 6 Å/mm). The new details in the exciton absorption lines of the two substances, observed as a result, are pointed out and discussed briefly. The experimental data are compared with various theories proposed to explain this phenomenon (longitudinal excitons, extremum loops, spatial dispersion). It is concluded that a sufficiently convincing and complete explanation of the complicated structure of the exciton lines can be made

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UDC: 535.34: 548.0

L 31495-66

ACC NR: AP6013024

2

only by extending these theories further and by obtaining new experimental data. Among the theories proposed are also Doppler shift and splitting, realization of para-exciton states, band splitting, increase in oscillator strength, etc. The author thanks S. A. Moskalenko and M. I. Shmiglyuk for useful discussions and for a preprint of their paper. Orig. art. has: 2 tables.

SUB CODE: 2C/ SUBM DATE: 05Oct64/ ORIG REF: 012/ OTH REF: 009

Card 2/2 mc

L 46247-66 EWT(1)/T IJP(c) GG  
ACC NRI AP6023909

SOURCE CODE: UR/0363/66/002/007/1171/1176

AUTHOR: Sobolev, V. V.

ORG: Institute of Applied Physics, Academy of Sciences, MoldSSR (Institut prikladnoy fiziki Akademii nauk MoldSSR)

TITLE: Structure of the energy bands of certain laminar crystals

SOURCE: AN SSSR. Izv. Neorg materialy, v. 2, no. 7, 1966, 1171-1176

TOPIC TAGS: semiconductor band structure, Brillouin zone, indium compound, gallium compound, selenide, telluride

ABSTRACT: The reflection spectra of InSe, In<sub>2</sub>Te, GaSe, and GaTe crystals were studied at T = 293°K in the range of fundamental absorption in order to determine the character of the structure of their bands in the range  $E > E_g$  according to the band theory for laminar and tetrahedral structures, and to attempt to correlate the known optical results. The structural reflection in the range  $E > E_g$  of laminar crystals was found to be due to direct interband transitions at certain principal points of the Brillouin zone. The reflection spectra and band structure (in the range  $E > E_g$ ) of GaS, GaSe, InSe, and GaTe are similar and differ markedly from those of In<sub>2</sub>Te. The relatively simple form of the reflection spectra for  $E > E_g$  and the complex nature of the absorption spectra at  $E \leq E_g$  of the laminar crystals indicate a simple structure of their bands in the range  $E > E_g$  and a very complex structure of the lower conduction bands

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UDC: 548.0:531

L 08875-67 EWT(m)/EWP(t)/ETI IJP(c) JU  
ACC NR: AP6025957 SOURCE CODE: UR/0051/66/021/001/0091/0093

AUTHOR: Kroitoru, S. G.; Sobolev, V. V. 26

ORG: none

TITLE: Reflection spectra of  $Mg_2Si$  and  $Mg_2Sn$  crystals  
2/21

SOURCE: Optika i spektroskopiya, v. 21, no. 1, 1966, 91-93

TOPIC TAGS: polycrystal, Brillouin zone, magnesium compound optic material

ABSTRACT: Reflection spectra of polished polycrystals of  $Mg_2Si$ ,  $Mg_2Sn$ ,  $Mg_2Si_{0.2}Sn_{0.8}$ ,  $Mg_2Si_{0.5}Sn_{0.5}$ ,  $Mg_2Si_{0.7}$ ,  $MnSi_2$ ,  $MnSi_{1.65}$ , and  $Mg_2Si_{0.6}Ge_{0.4}$  are studied in the range of 1 to 6 ev at 293°K. The purpose of the study was to quantitatively determine the positions of the energy zones of the crystals in various points of the Brillouin zone. All of these crystals ( $Mg_2X(X=Si, Ge, Sn)$ ) have antiferite lattices, are face-centered, with cubic translational symmetry. Curves of the reflection spectra are plotted and discussed in detail. Some of the peaks observed in the curves are interpreted. The authors thank Ye. N. Nikitin and N. A. Bul'onkov for supplying the crystals. Orig. art. has: 4 figures.

SUB CODE: 20/ SUBM DATE: 06Apr65/ ORIG REF: 000/ OTH REF: 010

Card 1/1 egk

UDC: 535.33 : 535.312 : 548.0

ACC NR: AT6024014

SOURCE CODE: UR/0000/65/000/000/0094/0104

AUTHOR: Sobolev, V. V.

ORG: none

TITLE: Low temperature edge absorption of cadmium selenide single crystals /5

SOURCE: AN MoldSSR. Institut prikladnoy fiziki. Teoreticheskiye i eksperimental'nyye issledovaniya fizicheskikh svoystv poluprovodnikovyykh materialov i drugikh kristallov (Theoretical and experimental studies on physical properties of semiconductor materials and other crystals). Kishinev, Izd-vo Kartya Moldovenyaskie, 1965, 94-104

TOPIC TAGS: cadmium selenide, optic spectrum, absorption edge, internal photoeffect, photoluminescence, temperature dependence, exciton, light polarization

ABSTRACT: This is a continuation of earlier work, carried out in 1956 - 1962 (Dissertation Abstract, Leningrad, 1962) where complex line structures of the absorption, reflection, photoluminescence spectra, and the spectral distribution of the internal photoeffect, were observed in cadmium selenide and similar crystals, and subsequently thoroughly investigated. The present paper reports experiments on the distinguishing features of absorption and reflection spectra of "pure" CdSe single crystals at temperatures 290, 160, and 77.3K. The spectra were obtained by a photographic procedure with a spectrograph having dispersion 3.5 - 70 Å/mm, in the 7000 Å region. The possibility of observation of longitudinal excitons was also investigated. The CdSe was in the form of plates whose optical C axis was always in the largest plane, so that

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ACC NR: AT6024014

the spectra could be investigated in polarized light. Many details of the investigation and of the apparatus are described elsewhere (ZhTF v. 26, 1622, 1956; FTT v. 2, 406, 1960; DAN SSSR v. 133, 56, 1960). The experimental results and their interpretation are described in detail. The results show that the nonotonic dependence of the absorption coefficient on the wavelength of the absorbed light experiences abrupt changes (edges) in three regions of the spectrum. These edges are polarized; the edge with the longest wavelength is polarized with the electric field perpendicular to C, while the second and third edges are partially polarized. The experimental data obtained on the character of the polarization and on the magnitude of the absorption coefficient in the region of the three edges is in good agreement with the theory of the complex band structure of uniaxial crystals. The results permit identification of a number of transitions and interband distances as well as their temperature dependence. Orig. art. has: 6 figures, 3 formulas, and 3 tables.

SUB CODE: 20/ SUBM DATE: 25Jul65/ ORIG REF: 005/ OTH REF: 004

Card 2/2

L 03008-67

ACC NR: AP6033483

SOURCE CODE: UR/0413/66/000/018/0087/0087

INVENTOR: Semikopnyy, I. D.; Sobolev, V. V.

ORG: none

TITLE: Device for studying visual functions. <sup>22</sup> Class 30, No. 186076

SOURCE: Izobret prom obraz tov zn, no. 18, 1966, 87

TOPIC TAGS: visual function, vision, electric motor, human sense, *OPHTHALMOLOGY*,  
*MEDICAL EQUIPMENT*

ABSTRACT: An Author Certificate was issued for a device, used to study visual functions, which consists of an electric motor, stimulus sources, displayed test objects, and a current source. To provide objective examination of visual functions and numerical indication of results obtained in the display of moving and stationary objects, a contact mechanism controlling frequency and duration of illumination of the moving object, a display mechanism controlling the duration of display of the stationary object, and a mechanism for setting exposure time, which controls duration of intervals in the display of two successive stimuli (for example, light and sound), are installed in the device.

SUB CODE: 06/ SUBM DATE: 08Dec64/ ATD PRESS: 5099

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UDC: 615.471.612. 843.7

ACC NR: A770500

SOURCE CODE: 770500000, 770500000

AUTHOR: Andriyesh, A. M.; Sobolev, V. V.

ORG: none

TITLE: Optical reflection spectra of chalcogenides of arsenic

SOURCE: AN BSSR. Institut fiziki tverdogo tela i poluprovodnikov. Khimicheskaya svyaz' v poluprovodnikakh i termodinamika (Chemical bond in semiconductors and thermodynamics). Minsk, Nauka i tekhnika, 1966, 212-216

TOPIC TAGS: arsenic compound, light reflection, glass property, optic spectrum

ABSTRACT: The purpose of the investigation was to study the change in the energy levels, in the nature and magnitude of interatomic interaction forces when compounds like  $As_2S_3$ ,  $As_2Se_3$ , or  $As_2Te_3$  are transformed from the crystalline state into the vitreous state. To this end the authors used spectrometers (SF-4 and SF-5) to investigate in the 1 - 6 eV region and at  $T = 295K$  the reflection spectra of  $As_2S_3$  (in the form of cleaved single crystals, glass with surface obtained by fracture, mechanically polished glass, chemically polished glass, and aged glass synthesized five years ago), and  $As_2Te_3$  (in the form of a mechanically polished polycrystal, a chemically polished polycrystal, and glass). Plots of the reflection spectra are presented and the various irregularities observed in the spectra of the different samples are listed and interpreted. Comparison of the reflection spectra of the crystals and glasses of the different chalcogenides leads to the following conclusions: In the

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UDC: 541.57



ACC NR: AT7003882

As<sub>2</sub>S<sub>3</sub> spectrum, the long-wave and short-wave maxima of the auripigment are close in position to the main peak and to the weak two maxima of artificially aged single crystal; the glass exhibits in addition to the "crystal" peaks also one structure-less broad band in the same region of the spectrum. In the As<sub>2</sub>Se<sub>3</sub> crystal, the main band is at 340 nm, whereas in the glass it is at 380 - 400 nm. The appearance of a peak at 340 nm in "aged" glass is due to its crystallization during the five years elapsed from the synthesis of the glass. In As<sub>2</sub>Te<sub>3</sub>, no difference is observed between the reflection of the glasses and crystals. From comparison with theoretical studies it is concluded that the maxima observed in the reflection of the single-crystal As<sub>2</sub>S<sub>3</sub> and As<sub>2</sub>Se<sub>3</sub> are due to direct interband transitions. Orig. art. has: 1 figure.

SUB CODE: 20/ SUBM DATE: 20Aug66/ ORIG REF: 013/ OTH REF: 001

Card 2/2

ACC NR: A1700100-

(1)

SERVICE CODE: UR/0000/66/000/000/0221/0228

AUTHOR: Sobolev, V. V.; Syrbu, N. N.; Shutov, S. D.

ORG: none

TITLE: Energy structure of bands of certain II - V, V - VI, and III - VI compounds

SOURCE: AN BSSR. Institut fiziki tverdogo tela i poluprovodnikov. Khimicheskaya svyaz' v poluprovodnikakh i termodinamika (Chemical bond in semiconductors and thermodynamics). Minsk, Nauka i tekhnika, 1966, 221-228

TOPIC TAGS: semiconducting material, semiconductor band structure, light reflection, optic spectrum, Brillouin zone, optic transition

ABSTRACT: The purpose of the investigation was to study the reflection spectra in the region  $E > E_g$  of a large number of anisotropic semiconductors ( $ZnSb$ ,  $CdSb$ ,  $Zn_4Sb_3$ ,  $Zn_3Sb_2$ ,  $Cd_4Sb_3$ ,  $Zn_3P_2$ ,  $Cd_3P_2$ ,  $Zn_3As_2$ ,  $Cd_3As_2$ ,  $ZnAs_2$ ,  $CdAs_2$ ,  $Sb_2S_3$ ,  $Sb_2Se_3$ ,  $Sb_2Te_3$ ,  $Bi_2S_3$ ,  $Bi_2Se_3$ ,  $Bi_2Te_3$ ,  $InSe$ ,  $In_2Te$ ,  $GaSe$ , and  $GaTe$ ) for the purpose of determining the energy gaps at different points of the Brillouin zone and comparing them with the band theories for anisotropic substances. The reflection spectra were investigated in the region 1 - 6 eV at  $T = 293K$ . Plots of all the spectra are presented and tables of the reflection peaks for different energies are given. The main conclusion of the data is that most reflection maxima of the crystals are due to direct interband transitions; their magnitudes on the energy scale are directly equal to the values of the corresponding interband gaps at different principal points of the Brillouin zone. The

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UDC: 541.57

ACC NR: AT7003884

various peaks observed on the reflection spectra for the different substances are interpreted from the point of view of the published theoretical and experimental papers dealing with the different compounds. Orig. art. has: 1 figure and 4 tables.

SUB CODE: 20/ SUBM DATE: 20Aug66/ ORIG REF: 011/ OTH REF: 008

Card 2/2

ACC NR: AT7003085

(A)

SOURCE CODE: UR/0000/66/000/000/0240/0250

AUTHOR: Kritovu, S. G.; Sobolev, V. V.; Syrbu, M. N.; Shutov, S. D.

ORG: none

TITLE: Energy band structure of crystals of groups IV, III - V, II VI, and the  $Mg_2Si$  type

SOURCE: AN BSSR. Institut fiziki tverdogo tela i poluprovodnikov. Khimicheskaya svyaz' v poluprovodnikakh i termodinamika (Chemical bond in semiconductors and thermodynamics). Minsk, Nauka i tekhnika, 1966, 240-250

TOPIC TAGS: semiconducting material, semiconductor band structure, light reflection, optic spectrum

ABSTRACT: The authors investigated the band structure, using the reflection spectra of pure and alloyed, polished and etched samples, cleaved crystals, and dendrites of groups IV and III - V, and polished and etched crystals of groups II - VI (Si, Ge, GaAs, GaSb, InAs, InSb, InP, GaP, and AlSb),  $Mg_2Si$ ,  $Mg_2Sn$ , and certain solid solutions of the systems InP-InAs, AlSb-GaSb, CdTe-HgTe, ZnSe-CdSe,  $Mg_2Si-Mg_2Sn$ , and  $Mg_2Si-Mg_2Se$ . The various peaks observed on the different spectra of the substances are listed and compared with results obtained by others. Tables of the experimental values of the direct interband transitions are presented. It is stated in the conclusion that the lack of concrete and sufficiently detailed calculations of the bands and schemes for the chemical binding forces for most solids makes it very difficult

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UDC: 541.57

ACC NR: AT7003885

to make further progress in the spectroscopy of crystals in k-space, which would help explain many physical and chemical properties of semiconductor compounds. Orig. art. has 3 figures, 1 formula, and 2 tables.

SUB CODE: 20/      SUBM DATE: 20Aug66/      ORIG REF: 007/      OTH REF: 001

Card : 2/2

ACC NR: AT7003886

SOURCE CODE: UR/0000/66/000/000/0251/0260

AUTHOR: Zalevskiy, B. K.; Lashkarev, G. V.; Sobolev, V. V.; Syrbu, N. N.

ORG: none

TITLE: Experimental studies of the structure of energy bands in certain rare earth element chalcogenides

SOURCE: AN BSSR. Institut fiziki tverdogo tela i poluprovodnikov. Khimicheskaya svyaz' v poluprovodnikakh i termodinamika (Chemical bond in semiconductors and thermodynamics). Minsk, Nauka i tekhnika, 1966, 251-260

TOPIC TACS: ~~compound semiconductor~~, refractory compound, sulfide, selenide, oxytelluride, rare earth compound, semiconductor band structure, reflection spectrum, ~~ENERGY BAND STRUCTURE~~

ABSTRACT: Reflection spectra in the 200—1200 mμ range of seven rare earth element chalcogenides and three oxytellurides have been obtained at 293°K and interpreted in terms of the theory of energy band structure of semiconductors. The compacted polycrystalline samples used in the experiments were prepared by sintering at 1000—1750°C powdered components in hydrogen sulfide or selenide atmosphere or in evacuated quartz ampules. Reflection spectra in the region of energy greater than the minimum forbidden energy gap (Eg) were similar for all the compounds studied. This fact indicates a great similarity in the structure of energy bands between chalcogenides and oxytellurides of the rare earth elements. Structural peculiarities

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UDC: none

ACC NR: AP7005002

(A)

SOURCE CODE: UR/0048/6./030/009/1555/1557

AUTHOR: Sobolev, V.V.

ORG: Institute of Applied Physics of the Academy of Sciences of the MoldSSR  
(Institut prikladnoy fiziki Akademii nauk MoldSSR)

TITLE: Low-temperature photoluminescence spectra of mixed crystals of A(II)B(VI) compounds /Report, Fourteenth All-Union Conference on Luminescence (Crystal Phosphors) held at Riga, 16-23 Sept. 1965/

SOURCE: AN SSSR. Izvestiya. Seriya fizicheskaya, v.30, no.9, 1966, 1555-1557

TOPIC TAGS: luminescence spectrum, band spectrum, line spectrum, zinc compound, cadmium compound sulfide, selenide, telluride, mixed crystal

ABSTRACT: The author has recorded the photoluminescence spectra at 4.2° K of CdS.CdSe single crystals of two different compositions and of coarse-grained mixed polycrystalline layers of each of the 10 systems containing two of the following compounds: ZnS, ZnTe, CdS, CdTe, and CdSe. The polycrystalline systems were investigated over a wide range of compositions. The principal luminescence bands are tabulated. All the investigated systems except those containing CdTe exhibited banded luminescence with equidistant bands. The failure of the CdTe-containing systems is ascribed to failure to achieve mixed crystals with ordered structures and

ACC NR:

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of the  $M_2X_3$  and MX compound semiconductors were derived from the weak reflection peaks of  $Ce_2S_3$ ,  $Nd_2S_3$ , and  $EuSe$  and from the reflection peaks in the 240—420 mμ region of  $Sm_2S_3$  and sesquiselenides of La, Ce, Pr, Nd, and Sm. Orig. art. has: 4 figures, 1 table, and 3 formulas.

SUB CODE: 07/

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ORIG REF: 011/ OTH REF: 010/

ACC NR: AP7005002

lattice constants of CdTe and those of the other materials. In some of the systems the energy separation of the equidistant edge luminescence bands was equal to the energy of a longitudinal phonon, and in others of them it was not. Line spectra of edge luminescence were observed in those of the polycrystalline CdSe.CdS layers that did not contain more than about 33% of CdS, but line spectra were not observed in the CdSe.CdS single crystals. The number and sharpness of the edge luminescence lines decreased with increasing CdS content. The strongest edge luminescence lines are ascribed to resonance Ausleuchtung from the lowest exciton states, and the other lines are ascribed mainly to excitons bound in the mixed crystal lattice. The absence of lines in the edge luminescence spectra of the single crystals is ascribed to the presence in the crystals of many centers at which there take place nonradiative exciton and electron-hole processes. Orig. art. has: 2 figures and 1 table.

SUB CODE: 20

SUBM DATE: none

ORIG. REF: 007

OTH REF: 001

Card 2/2



ACC NR: AP7005003

SOURCE CODE: UR/0048/66/030/009/1558/1559

AUTHOR: Sobolev, V.V.

ORG: Institute of Applied Physics of the Academy of Sciences of the Mold SSR  
(Institut prikladnoy fiziki Akademii nauk Mold SSR)

TITLE: Effects of impurities, heat treatment, and deformation on the luminescence and absorption spectra of cadmium sulfide and cadmium selenide /Report, Fourteenth All-Union Conference on Luminescence (Crystal Phosphors) held at Riga, 16-23 Sept. 1965/

SOURCE: AN SSSR. Izvestiya. Seriya fizicheskaya, v.30, no.9, 1966, 1558-1559

TOPIC TAGS: cadmium sulfide, cadmium selenide, luminescence spectrum, absorption spectrum, mechanical stress, heat effect, crystal impurity, single crystal

ABSTRACT: The author investigated the effects of different impurities, heat treatment at 700-800° C in vacuum and in different atmospheres, and mechanical stress on the edge luminescence, absorption, and reflection spectra of CdSe and CdS single crystals at 4.2° K. In the present paper the results are discussed qualitatively and two of the spectra are presented as examples. The heat treatment resulted in a broadening of the absorption spectrum, as though there had arisen an additional continuous absorption, and some smearing and shift of the line structure and the absorption edge. Different impurities and different effects on the absorption spectra, and some of them (Br and Cl) had no appreciable effect on the CdSe absorption spectrum.

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ACC NR: AP7005003

Mechanical stress was introduced by cementing the specimens to different substrates and subsequently cooling them. The effect of strain on the absorption spectra was very similar to that of heat treatment, and it is concluded that the effect of heat treatment is due to the introduction of internal deformations rather than to changes in the absorption at impurities and defects. Both CdSe and CdS are very sensitive to lattice distortions, and this sensitivity may find technical application. Heating the crystals, particularly in an atmosphere of the anion vapor, considerably altered the edge luminescence spectra, distorting the continuous edge luminescence spectrum and reducing the intensity of the edge luminescence lines. The presence of impurities greatly altered the luminescence spectra, resulting in the appearance of many narrow and sometimes strong lines between 6810 and 7100 Å and in enhancement of the doublet structure of the edge luminescence bands. On the basis of the present and other results it is concluded that "pure" CdSe crystals grown by the Frerichs technique are much more nearly pure than are the corresponding "pure" CdS crystals. Many details of the edge luminescence spectra can be explained on the basis of the exciton and exciton - impurity center models, but they are not so explained in the present paper. Orig. art. has; 2 figures.

SUB CODE: 20

SUBM DATE: none

ORIG. REF: 003

Card 2/2

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SOBOLEU, V. YA.

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